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ABSTRACT

This study investigated the dynamics of intersubjectivity within the zone of proximal development. Its theoretical framework is based on three principal approaches to intersubjectivity, those of J. Wertsch (1984; 1985), B. Rogoff (1990), and R. Rommertveit (1979), with reference also to self-regulatory speech (L. Vygotsky, 1986). Data were collected from social groups (excluding school groups) interacting with a Dymaxion map exhibit in a museum in a Midwestern U.S. city. As part of a larger data constellation, a focused microanalysis of discourse episodes illustrates the management of intersubjectivity during problem-solving activity. Within a problem-solving environment, this study presents evidence for the management of variable forms of intersubjectivity, including retreat into self-regulative speech, in a successful problem-solving activity. This process involves the problem-solver moving away from, then back toward, intersubjectivity. The analysis examines the dynamic nature of intersubjectivity in a new light and clarifies the otherwise ambiguous postulation of different levels of growth within the zone of proximal development (Wertsch, 1984). (Contains 36 references.) (SLD)

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Managing Intersubjectivity in the Context of an Informal Learning Environment

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Abstract

This study investigates the dynamics of intersubjectivity within the zone of proximal development. Its theoretical framework is based on three principal approaches to intersubjectivity (Wertsch, 1984, 1985; Rogoff, 1990; Rommetveit, 1979), with reference also to self-regulative speech (Vygotsky, 1986).

Data were collected from groups interacting with a Dymaxion map exhibit in a museum located in a Midwest U.S. urban city. As part of a larger data constellation, a focused microanalysis of discourse episodes illustrates the management of intersubjectivity during problem-solving activity.

Within a problem-solving environment, this study presents evidence for the management of variable forms of intersubjectivity, including retreat into self-regulative speech, in a successful problem-solving activity. This process involves the problem-solver moving away from, then back towards intersubjectivity. The analysis examines the dynamic nature of intersubjectivity in a new light and clarifies the otherwise ambiguous postulation of different levels of growth within the zone of proximal development (Wertsch, 1984).

The Management of Intersubjectivity

Several accounts of intersubjectivity have been discussed in the literature by authors such as Wertsch (1984, 1985), Rommetveit (1979) and Rogoff (1990). Each of these three scholars presents a rather binary account of intersubjectivity (i.e., that it either exists or does not), and also promotes a somewhat unidirectional approach to intersubjectivity (i.e., one with a forward marching trajectory only). Although the notion of variation in intersubjectivity levels has been discussed, a position which deals with a dynamic version of intersubjectivity has yet to be seriously outlined. Whether or not intersubjectivity might be a more partial and/or purposefully managed phenomenon in a problem-solving situation, likewise remains unclear. One possible reason for this relative absence of analysis of the dynamics of intersubjectivity is that intersubjectivity has been presupposed in adult-child problem-solving situations with researchers often assuming that adults have clear knowledge of the task at hand. In reality, this might not be the case.

INTERSUBJECTIVITY

Three accounts of intersubjectivity

When discussing Vygotsky's (1986) zone of proximal development, Wertsch (1984) introduced three theoretical constructs in order to overcome a potential ambiguity concerning different levels, or different magnitudes, of growth within the zone of proximal development (both within and between learners). Of these theoretical constructs, situation definition and intersubjectivity will be focused upon here.

According to Wertsch (1984), situation definition is "the way in which a setting or context [objects and events] is represented – that is, defined – by those who are operating in that setting" (p. 8). A redefinition of the situation is an indication of growth.

Intersubjectivity will be present when "interlocutors share some aspect of their situation definitions" (Wertsch, 1985, p. 159).

Moreover, Wertsch (1985) suggests that intersubjectivity may occur at "several levels" (p. 159). This reflects the fact that each person will move through their own personal growth trajectory according to their "actual" and "potential" levels of development (Vygotsky, 1978, as cited in Wertsch, 1985, p. 67) and that ontogenetic changes will vary across learners. In task performance according to this view, the "actual" level of development is demonstrated by a learner working on a task independently, and the "potential" level is achieved working under the guidance of an adult. In his account, Wertsch (1985) revealed four developmental levels of intersubjectivity. Each level is characterized by agreement and a degree of shared understanding of both objects and events occurring in the world.

In adult-child problem-solving activity, Wertsch (1984) postulates a possible tension due to multiple situation definitions. Adults might occasionally "slip into" (p. 15) their own level of understanding concerning the objects and events, in contrast to the child's level of understanding. However, he does not elaborate further upon this notion of "slipping."

In problem-solving tasks, as Rommetveit (1979) has suggested, communicative action is crucial to success. This involves the "transcendence of the private worlds of the participants" (p. 94). His conception of the "control" (p. 95) of the temporarily shared social world involves the monitoring of the speaker's "intentions" (p. 97), "anticipation" (p. 98) and "attribution" (p. 102) of what s/he says, and what is to be understood on the premises and/or perspectives of the interlocutors involved. Thus, Rommetveit's notion of

"control" focuses (predominantly) on the acts of speaking and listening, rather than the purposeful management of intersubjectivity in the goal-directed problem-solving activity (both individual as well as social).

Following Trevarthen's (1980) notion of intersubjectivity (as cited in Rogoff, 1990, p. 71), Rogoff (1990) emphasizes the understanding of a situation shared between people, as providing "a common focus of attention and some shared presuppositions that form the ground for communication" (p. 71). Rogoff's notion concerning the "management" (p. 80) of intersubjectivity (mainly that in mother-infant communication) is concerned with actively managing "attentional and action skills" (p. 82) in order to achieve a shared understanding of a situation and therefore communication. Moreover, Rogoff further discusses the "intersubjectivity of remembering and planning" (p. 169), i.e., the explicit discussion and planning of multiple subjectivities as interlocutors deal with the "definition of a situation and the direction of an activity" (p. 84).

Although, these three accounts differ along certain dimensions, they are similar in that each promotes a binary and unidirectional approach to intersubjectivity. Little, if any discussion, deals with any putative alternative patterns or approaches towards, as well as retreat from, intersubjectivity as a purposeful activity.

The initial analysis of the data acquired during the current study carried out at the St Louis Science Center in Missouri, however, points to somewhat flexible and dynamic processes of intersubjectivity which could be partial and managed in several different ways. The degree to which intersubjectivity is approached, or departed from, will depend upon the level of active and purposive application on both the inter- and intra-mental

planes. The importance of dynamics concerning intersubjectivity remains to be fully explored.

In order to enhance our understanding of the dynamics of intersubjectivity, the concept of self regulative-speech will be outlined briefly in the following section.

Self-Regulative Speech

Self-regulative speech was first reported by Piaget in connection with children experimenting with the use of language. It was viewed as giving pleasure to children expressing their thoughts. This concept influenced Vygotsky, although he held a quite different view.

Of the many complex problems discussed by Vygotsky (1986), the relationship of speech and thought is one that has been of particular interest to a growing number of scholars. The development of this relationship consists in three general stages, moving from communicative or social speech, through egocentric, to inner speech. Egocentric speech was viewed as "[going] underground" (Vygotsky, 1986, p. 33) and later transforming into inner speech, or "internalized" verbal thought (Vygotsky, 1986, p. xxxv). Such a development involves the important transitional relationship between intermental (social) and intramental (individual) functioning (see Vygotsky's conception of "internalization", 1986, p. xxxvi).

Egocentric speech is similar to inner speech in a number of ways. Both appear on the intramental plane. Self-regulative speech reflects a "speech-for-oneself" whereas social speech reflects a "speech-for-others" (Vygotsky, 1986, p. xxxv). Two major criteria differentiate self-regulative speech from social speech, one concerns its social function, the other its structural aspects.

Social speech is a form of external speech used for communicative purpose between interlocutors. Self-regulative speech may be used in one's private world and addressed to oneself. The structural aspects of social speech resemble the normative characteristics of adult speech, whereas self-regulative speech is characterized by its tendency to approximate thought or "internalized" verbal thought (Vygotsky, 1986, p. xxxv).

Contrary to Piaget's conceptions of egocentric speech, Vygotsky (1986) proposed egocentric speech to be a function of "realistic thinking" (p. 33). It "approximates the logic of intelligent, purposeful action and thinking" (Vygotsky, 1934, as cited in Wertsch, 1985, p. 116-7). At times, it could also be viewed as affording a cognitive tool in "seeking and planning the solution of a problem" (Vygotsky, 1986, p. 31). In the case of solving problems, Vygotsky suggested that occurrences of egocentric speech would increase when one encounters cognitively difficult moments, for example, those demanding higher order mental functioning for active and reflective thinking (Vygotsky, 1986). Based upon Vygotsky's (1986) experimental findings, the strategic use of egocentric speech has been shown to have a regulative function on activity, for example, a child's drawing task. In adult-child problem-solving activity, one might assume that egocentric speech could be used for the purpose of managing "purposeful behaviors" (Vygotsky, 1986, p. 31).

For the purposes of this paper, self-regulative speech is defined as speech utterances directed by speakers to themselves when they are engaged in a problem-solving task setting. It is accessed, and used primarily for the speaker. Egocentric speech and inner speech both qualify under this heading.

Self-regulative speech does not, however, only represent subjectivities. It also provides a mechanism for shaping the contact between subjectivities, i.e., for creating intersubjectivity.

THE RESEARCH QUESTION AND CLAIM

Research Gap and Research Question

As noted earlier, the three accounts of intersubjectivity reviewed above reflect rather binary views of intersubjectivity, i.e., it either exists or does not. They also promote a somewhat unidirectional approach to the development of intersubjectivity, i.e., one having solely a forward marching trajectory. Very little discussion to date has dealt with alternative patterns or approaches to intersubjectivity.

Although the intersubjectivity literature has been recognized as important to discussions of the zone of proximal development and pedagogical instruction, little discussion has concerned with the role of power and authority, in particular with reference to the invisible institutional voice.

The research questions of this paper ask: whether there might be alternative intersubjective patterns in contrast to the predominately unidirectional approach to intersubjectivity, e.g., perhaps a less static and instead a more dynamic sense of intersubjectivity. Might intersubjectivity be perhaps partial and/or purposefully managed in a problem-solving situation ? Could intersubjectivity take into account authoritative institutional representations ?

For the purpose of this study, intersubjectivity is defined as a shared understanding between interlocutors with regard to what they are going to do, how they are going to do it, and whether or not they are doing it well in task performance. In other

words, shared understanding of their goals, context, action, operation of actions, use of objects and evaluation of outcomes of actions.

Principle Claim

In this paper, the notion of intersubjectivity elaborates upon the zone of proximal development, in particular the dynamics of intersubjectivity. Both the intermental and intramental planes and their relationship to the construct of self-regulative speech are taken into consideration. Such a relationship would appear to be complex from any number of positions and remains to be fully investigated.

According to Vygotsky (1986), thought is shaped by speech. Wertsch (1984) suggests further that speech can create and condition an intersubjective situation definition, not just reflect its existence. This paper argues that, in solving problems, one could operate in such a way as to retreat into self-regulative speech as a separate line of strategic reasoning in the context of intersubjectivity, resulting in participants approaching and temporarily retreating from intersubjectivity on the intermental plane, thus providing a mechanism for managing such intersubjectivity.

Selected segments of a transcript are presented to illustrate these claims. Due to the largely qualitative nature of the data collated, generalizability is not an intended goal for this study (though it may form the basis of a separate analysis).

THE RESEARCH PROCESS

Data Collection

Audio-video recording data were collected from social groups interacting with a focal exhibit, the Dymaxion map (or 'Make a map or make a globe' puzzle) at the St Louis Science Center, Missouri, during the course of one week in March, 2002. Social

groups were characterized by various combinations of parties visiting the museum, for example, different generations of family members, relatives and friends, but not school groups. Of sixteen video-recorded groups, four were selected for microanalysis, transcribed and coded. Informed consent was obtained. Exit interviews and a one-page questionnaire were collected from three of the four groups after they exited the exhibit.

Of this larger data constellation, and for the purposes of this paper, intersubjectivity management was analyzed in terms of the retreat into self-regulative speech as demonstrated by a target group, more specifically by one participant, hereafter named "JJ." A total of eleven occurrences of retreating into self-regulative speech were identified (see examples in Results and Discussion below).

Self-regulative speech was categorized in addition to two other categories of addressivity (i.e., participant and group). The category of addressivity was derived from Bakhtin's (1981) idea concerning dialogicality of voices in terms of "the speaking personality, the speaking consciousness" (as cited in Wertsch, 1985, p. 226). Paralinguistic cues were also included in the coding procedure for retreating into self-regulative speech. These included mumbling, weak tones of voice, intense concentration and little or no eye contact.

Context and Participants

A fifty-four-year-old father (JJ) and his twelve-year-old son (AN) were observed and recorded as they arrived at a Dymaxion map (or the 'Make a map or a globe' puzzle) exhibit. They had completed most of an interactive two-dimensional flat map on a table when recording began. In particular, they were dealing with some hypothesized "missing pieces" (an apparently problematic perceptual mis-projection on their part of the two-

dimensional map onto a three-dimensional globe). They nonetheless completed the entire puzzle within 12 minutes.

The Dymaxion map was situated in the Ecology and Environment-Future Gallery at the St Louis Science Center. The primary theme of the Ecology and Environment exhibition was change over time, including topics such as the dynamic natural environment, interdependent ecological systems, and the impact of humanity upon the environment. According to a personal communication with a senior Gallery staff at the Center, the educational goals of the Dymaxion map were two-fold: (1) it presented the "most accurate representation of water-based map," and (2) it aimed to "generate group interaction" when engaging in the task (personal communication with senior Gallery staff at the Center on March 29, 2002).

An enlarged Dymaxion map was also displayed on the atrium wall in front of the puzzle exhibit. It will be hereafter referred to as the 'model' version. The two-dimensional flat map and three-dimensional globe will be referred to as being the 'copy' versions.

ANALYSIS AND DISCUSSION

In this section, selected segments of a transcript provide illustrations of the management of intersubjectivity. A total of eleven utterances of retreating into self-regulative discourse are classified and presented from four episodes (each marked with an asterisk, "*"). These utterances accounted for 52% of all the utterances produced by JJ. Analyses were conducted with particular reference to retreat into self-regulative speech as a coexistent line of strategic reasoning in the context of intersubjectivity. For transcription conventions, see Appendix at the end of this paper.

Episode 1 (Negotiating With the Institutional Voice)

The first incidence of retreating into self-regulative speech is an example of two trajectories of intersubjectivity, illustrating a retreat from intersubjectivity followed by re-entry. Adult participant, (JJ), was trying to identify a specific puzzle piece. At the beginning of the video-recording, by which time approximately half of the two-dimensional flat map had already been completed, JJ said,

*1	JJ	Looks like they broke that piece off (... make of).
*2	(JJ)	(What's that piece?) [AN looks over JJ's shoulder.]
3	(JJ)	Now, where's Greenland? [JJ looks up to wall three times.]
4	AN	Maybe this is (it). [Both looks up to wall. AN looks at a piece.]

Assuming that JJ and AN had established intersubjectivity in order to get them this far, utterances 1 and 2 were interpreted as retreating into self-regulative speech in terms of their forms, functions and the way they were produced. JJ spoke here with a relatively mumbling and weak tone of voice, intense concentration and little eye contact with his son, AN.

While attempting to insert a new puzzle piece on the flat map into the Yellow Sea and East China Sea, (as if speaking to himself) JJ seemed to be in the process of making sense of the piece adjacent to one previously inserted (correctly). Utterance 1 suggests that JJ's progress might have been disrupted by the rather unfamiliar triangular-shaped puzzle pieces. This appeared to be the first problematic moment which JJ encountered. When speaking, JJ was facing a large model wall map in near distance. He appeared to consult the model map on the wall while AN was looking over his shoulder.

Utterance 2 appears to provide an instance of thinking aloud, seeking the identification of the next piece, thought to have been "broken off." It did not appear that JJ was addressing AN, although the syntactic structure of his self-directed speech would appear to closely resemble an intermental level of functioning.

Interestingly, a shift towards intersubjectivity was also noted in the utterance immediately following utterance 2. JJ asked, "Now, where's Greenland?" (utterance 3). Both utterances 2 and 3 involved solicitation. Nevertheless, in terms of addressivity, the solicitation of utterance 3 was quite different. When speaking, JJ here spoke with a distinctively louder voice, he moved his body and his face towards AN, as if he was addressing the question to AN. Moreover, it was contextually informative in the way that JJ might have introduced more information into the situation and event, e.g., the use of a proper noun, "Greenland" to specify a specific spatial-locative search strategy for planning or guiding an action pattern. AN's response to utterance 3, "Maybe this is it" (utterance 4) shows that his situation definition was matched to that of JJ's, indicating maintenance of a similar level of intersubjectivity as a result.

Semantically speaking, the use of the third person plural pronoun "they" in utterance 1 refers to non-participants in the utterance-act, i.e., the institutional exhibit designers who were responsible for the exhibit layout. In reality, although these designers were spatiotemporally distant from the exhibit context, JJ was aware of the presence of these invisible participants.

Both utterances 1 and 2 have nearly complete syntactic structure, albeit the subject was omitted in utterance 1, suggesting the kind of predicativity outlined by Vygotsky (1986).

In summary, between utterances 2 and 3, there appeared a dual stream of reasoning, with retreat into the self-regulative speech seeming to be temporary and tactical, followed by re-entry into intersubjectivity which then appeared to be effectively monitored by JJ as if he was keeping track of where he had left off. Moreover, utterances 1 and 2 did not help foster intersubjectivity with AN. Instead, they seemed to elucidate JJ's separate line of strategic reasoning or situation definition on the intramental plane (as an individual), in this case, negotiating with the invisible authoritative institutional voice. This suggests that JJ was trying to think ahead in the process of problem-solving in order to cognitively prepare himself, perhaps serving also to maintain his cultural seniority as the mature member of the dyad (Wertsch, 1984; see also Vygotsky's cultural development, 1986). Such behavior is often evident during the inductive preparation of teachers in training, prior to their actual teaching.

It is also worth noting that there is a remarkable difference between this dyad in the museum setting on the one hand, and an educator-pupil situation in formal schooling on the other. In the zone of proximal development, JJ and AN were dealing with a problem, for which the solution was yet to be uncovered, whereas, in a classroom situation, educators might more typically use a set of standard answers and procedures with which to guide action patterns. Wertsch (1991) has rightly described such speech accompanied by planned action as the "speech genre of formal instruction" (p. 112). For an analysis of how intersubjectivity is created and maintained (or not) in instructional discourse in science classrooms, see Mortimer and Wertsch, (in press).

Episode 2 (Self-Regulating)

Episode 2 provides an example of the retreat into self-regulative speech as a cognitive function of purposefully monitoring the complex pattern of one's own problem-solving actions (here, in placing a puzzle piece). It took place after JJ had inserted the "Greenland" piece as identified by AN into the two-dimensional flat map. JJ then said,

*5	JJ	This goes up here. (... and back and forth), (now it looks better) ((pause)) [looks up to wall].
6	JJ	That, be careful with that. (... .) [AN nearly hits JJ's face with a piece in his hand. JJ looks up to wall twice and shows a perplexed look. AN places an ocean piece on the top of the flat map.]

As suggested earlier, it would appear that JJ might have drifted back to his intramental functioning in guiding and monitoring his problem-solving process, i.e., by saying aloud the positioning of the piece ("this goes up here"), so raising his level of problem-solving awareness. Interestingly, this was immediately followed by his own evaluation concerning the outcome of his placement ("now it looks better"). In so doing, he would appear to have both negotiated and updated his situation definition, while taking into consideration the task requirement as displayed by the institutional objects to hand (i.e., the copy version of the Dymaxion flat map as well as the model map on the atrium wall). For example, throughout the whole problem-solving session, JJ made sixteen references to the model map (as compared to AN's fifteen).

As it turned out, JJ's self-regulative questioning, answering, and evaluative speech helped clarify the situation definition. For example, fully two-thirds of the flat map had

by then become completed. It thus proved to be an effective operation (or at least one strongly concurrent with success).

In summary, it would appear that JJ retreated into his self-regulated speech in order to purposefully monitor the complex pattern of his problem-solving actions in terms of placement execution and evaluation (see also Vygotsky, 1986). By giving instruction to AN immediately after the retreat in utterance 5, "be careful with that" (utterance 6), JJ re-entered intersubjectivity.

Episode 3 (Mediating Between the Institutional Voice and Personal Misconception)

Episode 3 provides an example of retreating into self-regulative speech in connection with JJ's personal misconception of an external institutional representation. It took place after JJ and AN had almost finished the flat map, with only a few gaps remaining. Then, JJ stated:

*7 JJ Missing pieces [looks up to wall]. Missing this one. [He points at the flat map and searches under the table.] [Both JJ and AN stand up and search for the postulated missing pieces. AN explores the globe.]

*8 JJ (I wonder where it could be.)

In general, gaps are not allowed in the schema of a jigsaw puzzle. Given the gaps on the flat map, JJ assumed the existence of "missing pieces" as the reason for them. The problematic area lay where the Yellow Sea and East China Sea were. What he saw did not match what he (and indeed most of us more familiar with the commonly presented Mercater flat projection of earth's continents) was familiar with. If correct, this would also reveal a much deeper tension between his own putative inner voice (a puzzle should

not have gaps) and the institutional representation that a completed puzzle might indeed display gaps. This mismatch could be traced back to his own misconception. By addressing this misconception through reasoning about "missing pieces," he did indeed move closer to the solution of solving the puzzle problem. They might, otherwise have left the exhibit without making complete sense of the activity.

At the moment of saying "missing pieces" (utterance 7), AN was standing behind JJ and was looking in another direction, as if he may have been off-task for a short while. JJ then further postulated the whereabouts of those "missing pieces" as if speaking to himself. He was not talking directly to AN. Moreover, the clear predicative use of the "missing pieces" on two occasions, i.e., the ellipsis of sentence subject, the high degree of referentiality with the use of demonstrative "this" and singular pronoun "it," and the idiomatic expression further support the interpretation of this utterance as retreating into self-regulative speech.

In summary, in episode 3, the retreat into self-regulative speech could be construed to have served the function of mediating between JJ's own thoughts and an external institutional representation. His situation definition seems to have been characterized by two coexisting trajectories: the one representing a situation definition on his intramental plane; the other representing a relatively more open situation definition, shared with AN.

Episode 4 (Two Trajectories of Intersubjectivity: A Successful Negotiation Between Their "Missing Pieces" and the Institutional Representation)

Episode 4 is an example of retreating into self-regulative speech as a way to self-regulate or guide action and a dual mode of intersubjectivity. It involves retreating from

intersubjectivity and then re-entering it. The retreat (see utterances 9, 10, 12, 14; 20 and 22) took place after AN's first attempt to redefine the situation definition concerning the "missing pieces" by suggesting rotation of puzzle pieces. AN said, "this is it" [points at the map] (utterance not shown below). The problematic area lay amidst the Yellow Sea and East China Sea. Following his initial rejection that "we got it wrong" (utterance not shown), JJ completed the rotation and further explored AN's idea of shifting pieces in order to redefine the situation definition. Suddenly, JJ exclaimed, in a weak tone of voice,

*9 JJ (This was the place.) [JJ swiftly shifts around another piece where the northeast part of Asia is. He puts his umbrella down, shifts another piece and back again. He does that twice.] (Let's) turn the puzzle around.

*10 JJ It doesn't work. (...).

11 AN Maybe, you should (...) [sits on floor and looks up to wall].

*12 JJ (China is here. Japan is here). [JJ continues to shift the pieces around and looks up to the map on the wall.]

13 AN China is there [points at China on the map], (...) [then he looks up to the map on the wall twice].

*14 JJ [JJ shifts the piece back and looks up to the map on the wall twice.] (... .) [AN lays both hands on the map. JJ shifts the piece back again.] (They don't put together, weird) [shifts the piece back again]. 'Cause it's why it's made to go on like THAT [points to the globe]. You can't lay it flat [shifts the piece back again].

15 AN [AN was reading aloud the label.] (It says… .)

16 JJ That's why if you are going to put it on there it will work [points to the globe again]. (I think we need some more pieces) [points at the gap on the flat map]. [AN watches most of the time.]

17 AN [AN walks towards the globe.] Look at this [taps his hands on the top of the globe]. (Do you know) they wouldn't all fit [points at the bottom of the globe].

18 JJ But this wouldn't fit either [points at the pieces on the flat map].

At this point, JJ was enthusiastic about shifting the pieces around in order to match the pattern of physical map with his mental map. He first identified the location of the piece to be shifted, "(this was the place)" (utterance 9). Then he vocalized the shifting, "(let's) turn the puzzle around" (utterance 9). It is worth noting that throughout this episode he vocalized in a mumbling tone of voice. His intense concentration with little or no eye contact indicated little desire to open communication. Moreover, he was looking very intently around the problematic area where the Yellow Sea and East China Sea lay.

JJ continued to redefine the situation definition by identifying the proper nouns associated with the images printed on the pieces, e.g., "(China is here. Japan is here)" (utterance 12) and evaluating his own pattern action, "(They don't put together, weird)" (utterance 14). It was not until after a few rotations that JJ finally began to successfully negotiate with the truth of the "missing pieces," when he said, "'Cause it's why it's made

to go on like THAT. You can't lay it flat" (utterance 14). It was noteworthy that this last articulation was made louder at this point, as if he had successfully convinced himself that the gaps on the two-dimensional flat map would nonetheless fit onto the three-dimensional globe. [NB: According to the inventor of the Dymaxion map, Buckminster Fuller (Fuller, 2002), the "Dymaxion map is the only map of the entire surface of the earth that reveals our planet as it really is: an island in one ocean without any visible distortion of the relative shapes and sizes of the land areas, and without splitting any continents."

Following his own direct question, "(How would it go on the frame?)" (utterance 19), his successful negotiation with the "missing pieces" was finally completed when he provided his resolution in utterances 20 and 22,

19 JJ (How would it go on the frame?)

*20 JJ Oh, I see if you put it on there [points to the globe, then closes both palms

21 AN See then you'll think [moves towards the globe and points at the bottom of the globe].

*22 JJ together to make a clap] they will all come together [rotates the piece back the final time and position].

23 JJ You know where to put that, it's Sidney (...) at the bottom. [JJ points to the bottom of the globe, then he moves towards the exhibit label which is situated to their right and reads it. AN is reading it with JJ. Then JJ uses his umbrella to point at the center of the flat map, i.e., the Arctic, then steps back a little. AN

touches the flat map on the table then rests his body on the globe.]

Gesture also played an important part in interpreting his completed resolution. Despite the fact that JJ's retreat into his self-regulative speech was clearly articulated, he appeared to have refused to re-enter an overtly shared intersubjectivity with AN when he interjected and attempted to postulate an alternative (see utterance 21). It would appear instead, that JJ chose to continue to remain on his own intrapyschological plane in order to finish his think-aloud resolution (see utterances 20 to 22).

It is interesting to note here that, immediately after retreating into the self-regulative speech of utterance 22, JJ was able to move forward to re-establish intersubjectivity with AN by providing directive speech, "You know where to put that ?, it's Sidney (...) at the bottom" (utterance 23). A similar intersubjective response was identified shortly after the retreat. When responding to AN's comment, "they wouldn't all fit" (utterance 17), JJ responded, "but this wouldn't fit either" (utterance 18). Hence, JJ seemed to have purposefully and smoothly accessed and navigated between intra- and inter-mental planes. It was as if he kept track of where he had left off when retreating, and managing to monitor and maintain a dual stream of reasoning between planes (e.g., from utterances 9, 10, 12, and 14 to utterance 18; from utterances 20, and 22 to 23).

On the whole, the syntactic structures in this episode of retreat into self-regulative speech were simple, albeit not fragmented. It may well be that despite the retreat from intersubjectivity, JJ remained conscious of his mentoring role with regard to his own son, AN. The semantic flow was idiomatic, except for utterance 12, in which JJ identified the proper nouns of locations appearing on the puzzle piece images.

In summary, it would seem that during problematic moments (see Episodes 3 and 4), e.g., when JJ accidentally created the assumed "missing pieces" problem, he consulted his inner thoughts through the trajectory of retreat into self-regulative speech. In so doing, he created a second situation definition, one reflecting a closed negotiation between his intrapsychological plane and the institutional representation. This contrasts with an alternative situation definition, involving open intersubjective negotiation with AN. Whether or not such negotiation takes place on the inter- or intra-mental plane would seem to depend upon JJ's desire to approach or retreat from the context of intersubjectivity. For example, through his retreat from intersubjectivity towards his intrapsychological plane, JJ successfully negotiated a shared situation definition between his intrapsychological (individual) and institutional representations. Such a negotiation may have promoted a crucial resolution in maintaining a later shared situation definition with AN, eventually leading to the solving of the puzzle problem. Such a position is congruent with Bakhtin's (1981) conception of dialogic voices.

It is interesting to note that AN took initiative in matching JJ's situation definition despite the fact that JJ was busy (independently) negotiating his intrapsychological situation definition with the institutional representation. AN's utterances (see utterances 11, 13 and 21) were responsive to JJ's prior evaluation (see utterance 10), identification (see utterance 12) and solicitation (see utterance 19). This would seem to suggest that AN was demonstrating yet another intersubjective pattern in responding to utterances which were not intended to be social speech. This reflects a potential tension or fuzzy retreat boundary from intersubjectivity.

In attempting to redefine situation definitions, AN suggested the rotation of pieces to resolve the "missing pieces" (the phrase was first mentioned by JJ at utterance 7). Moreover, by successfully negotiating his intrapyschological situation definition with the institutional representation, JJ redefined his own intrapsychological situation definition (see utterances 14, 20 and 22). AN proposed the final crucial situation redefinition concerning the color coding of the puzzle pieces, by saying:

24 AN Hey Dad, look, Dad [points and looks up to wall]. This is the same thing up there [points and looks up to the map on the wall then points to the flat map], (there is there) [points and looks up to wall then points to the flat map] (and this is this) [points and looks up to wall then points to the flat map. JJ looks up to wall too. AN then puts his hands in his jacket pockets.]

25 JJ Oh, yeah, (the … pieces do tell you how to do it) (… it was painted up like that). [Both looks up to wall. JJ exits the exhibit.] [Laughing.] We're trying to figure it out, (and it's right up on the wall) [Laughing. AN follows his father to leave.]

AN's final situation redefinition helped JJ understand the color representation of the model map on the wall in relation to the flat copy map. In so doing, AN was demonstrating impressive growth in his development, following the facilitation and scaffolding provided by his father, as well as his own resourceful learning strategies.

CONCLUDING REMARKS

In conclusion, this study has presented evidence for the management of variable forms of intersubjectivity and the retreat into self-regulative speech in a successful

problem-solving activity. This process involved the problem-solver moving away from, then back towards intersubjectivity on the intermental plane. The analysis presented here has examined the dynamic nature of intersubjectivity in a new light and has clarified the otherwise ambiguous postulation of different levels of growth within the zone of proximal development (Wertsch, 1984).

In contrast to the approaches of Rogoff (1990), Rommetveit (1979) and Wertsch (1984, 1985), which suggest the binary form of intersubjectivity and a unidirectional developmental trajectory, the analyses and interpretation provided here propose a more dynamic form of intersubjectivity which could be partial and managed at several different levels. This proposal also considers the invisible participant of the institution in the discursive process. As Vygotsky might predict, JJ retreated into self-regulative speech at problematic points in order to regulate and manage his problem-solving actions. Furthermore, JJ effectively monitored his approach-and-retreat movements in the context of intersubjectivty, re-entering where he had left off. The analysis also suggests that the appearance of self-regulative speech is not at all random. Instead, it is strategic. One should bear in mind, however, that the way specific dynamics play out would vary at a different stage of intersubjectivity.

The temporary retreat from, and return to, intersubjectivity is not, however, necessarily to be characterized by a clean break or boundary. For example, AN responded to JJ's utterances which were not intended to be social speech (e.g., see AN's utterances 11, 13 and 21 in responses to JJ's self-regulative utterances 10, 12 and 19). This may be taken to reflect the potential tension that can result from temporarily retreating from intersubjectivity. Such a confusing form of intramental functioning does not reveal itself

to be manifest or to have a clear boundary. Furthermore, this suggests that it took a lot of effort in terms of semiotic skill, on JJ's part, in order to keep in mind where he was in the intersubjective and intrasubjective levels so as to respond most appropriately to any possible interferences taking place between inter- and intra-mental planes.

Finally, and contrary to the prevailing presupposition that adults have good knowledge and skills in handling tasks within the zone of proximal development, JJ and AN were dealing with a problem, for which the solution was yet to be uncovered for them both. However, JJ's knowledge and skill in dealing with this task might be lacking in appropriate exposure. It would seem that well-defined problem-solving skills on the adult's part might reveal a more regular pattern of intersubjectivity, whereas working on an ill-defined problem may give rise to a more dynamic form.

A semi-structured exit interview was conducted with JJ and AN after they left the exhibit, and proved both useful and insightful. It revealed that they both had increased their understanding of the Dymaxion map and had an enjoyable time. JJ reflected, "It's a lot more difficult to put something on a flat surface than on a round surface, different type of projection. We learned how to put together different shapes. I learnt that I should have looked at the wall first, I would have known how to do it. It's a lot of fun. We should have looked at the wall first. It shows us how to do it." AN commented, "I like it. It's fun. I learned about projection and learned about (that at school today). And then, use your resources." With their joint effort, they solved the mystery of the "missing pieces" and the seeming discontinuity between the model and task (copy) versions of the Dymaxion map before them. They left with good humor and laughter.

In conclusion, this analysis and identification of variable forms of intersubjectivity clarifies that creating, effectively monitoring and managing intersubjectivity is crucial to one's successful operation within the optimal zone of proximal development. The findings of this study have important implications for issues in problem-solving in terms of both approach and procedure, and for pedagogical instruction in solving problems.

APPENDIX

Transcriptions Conventions

(...)	Unintelligible reading
(word)	Tentative reading (single word or a couple of words)
(... word... words)	Tentative reading (intermittent reading)
[ ]	Paralinguistic cues, both vocal and non-vocal (e.g., [AN looks ov JJ's shoulder])
CAPITAL LETTERS	Spoken with emphasized tone
((pause))	Indicate pause (no units of time specified)

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